

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a semiconductor substrate;

a plurality of diffusion layer patterns formed on the  
5 semiconductor substrate;

an insulation film formed between the plural diffusion layer  
patterns on the semiconductor substrate; and

a through plug formed to be partly surrounded by the  
insulation film without being in contact with the plural diffusion  
10 layer patterns and to pass through the insulation film and the  
semiconductor substrate.

2. A semiconductor device comprising:

a semiconductor substrate;

a plurality of diffusion layer patterns formed on the  
15 semiconductor substrate;

an insulation film formed between the plural diffusion layer  
patterns on the semiconductor substrate; and

a through plug formed to be partly surrounded by the diffusion  
layer pattern without being in contact with the insulation film and  
20 to pass through the diffusion layer pattern and the semiconductor  
substrate.

3. A semiconductor device comprising:

a plurality of semiconductor chips, at least one of the plural  
semiconductor chips having: a semiconductor substrate; a plurality  
25 of diffusion layer patterns formed on the semiconductor substrate;  
an insulation film formed between the plural diffusion layer  
patterns on the semiconductor substrate; and a through plug formed  
to be partly surrounded by the insulation film without being in

contact with the plural diffusion layer patterns and to pass through the insulation film and the semiconductor substrate, or a through plug formed to be partly surrounded by the diffusion layer pattern without being in contact with the insulation film and to pass through  
5 the diffusion layer pattern and the semiconductor substrate; and

a connecting member electrically connecting the through plugs of the at least one of the plural semiconductor chips to a semiconductor chip of the plural semiconductor chips other than the at least one of the plural semiconductor chips.

10 4. A semiconductor device as set forth in claim 1, further comprising a pattern portion formed above the diffusion layer pattern and/or the insulation film without being in contact with the through plug, the pattern portion using as a material thereof one kind selected from a group consisting of aluminum (Al), tungsten  
15 (W), titanium (Ti), copper (Cu), tantalum (Ta), and a chemical compound composed of at least one metal out of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), and tantalum (Ta).

5. A semiconductor device as set forth in claim 2, further comprising a pattern portion formed above the diffusion layer  
20 pattern and/or the insulation film without being in contact with the through plug, the pattern portion using as a material thereof one kind selected from a group consisting of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), tantalum (Ta), and a chemical compound composed of at least one metal out of aluminum (Al),  
25 tungsten (W), titanium (Ti), copper (Cu), and tantalum (Ta).

6. A semiconductor device as set forth in claim 3,  
wherein the at least one of the plural semiconductor chips further comprises a pattern portion formed above the diffusion layer

pattern and/or the insulation film without being in contact with the through plug, the pattern portion using as a material thereof one kind selected from a group consisting of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), tantalum (Ta), and a chemical compound composed of at least one metal out of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), and tantalum (Ta).

7. A semiconductor device as set forth in claim 1, further comprising a pattern portion formed above the diffusion layer pattern and/or the insulation film, the pattern portion using as a material thereof one kind selected from a group consisting of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), tantalum (Ta), and a chemical compound composed of at least one metal out of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), and tantalum (Ta),

wherein the through plug is partly surrounded also by the pattern portion above the diffusion layer pattern and/or the insulation film.

8. A semiconductor device as set forth in claim 2, further comprising a pattern portion formed above the diffusion layer pattern and/or the insulation film, the pattern portion using as a material thereof one kind selected from a group consisting of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), tantalum (Ta), and a chemical compound composed of at least one metal out of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), and tantalum (Ta),

wherein the through plug is partly surrounded also by the pattern portion above the diffusion layer pattern and/or the insulation film.

9. A semiconductor device as set forth in claim 3,

wherein the at least one of the plural semiconductor chips further comprises a pattern portion formed above the diffusion layer pattern and/or the insulation film, the pattern portion using as  
5 a material thereof one kind selected from a group consisting of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), tantalum (Ta), and a chemical compound composed of at least one metal out of aluminum (Al), tungsten (W), titanium (Ti), copper (Cu), and tantalum (Ta), and

10 wherein the through plug is partly surrounded also by the pattern portion above the diffusion layer pattern and/or the insulation film.

10. A semiconductor device as set forth in claim 1, wherein each of the plural diffusion layer patterns has a metal silicide  
15 layer.

11. A semiconductor device as set forth in claim 2, wherein each of the plural diffusion layer patterns has a metal silicide layer.

12. A semiconductor device as set forth in claim 3, wherein  
20 each of the plural diffusion layer patterns has a metal silicide layer.

13. A semiconductor device as set forth in claim 1, wherein the through plug has a columnar electric conductor made of copper and an insulation layer made of any one of silicon oxide, silicon  
25 nitride, and a combination of silicon oxide and silicon nitride, the insulation layer surrounding the columnar electric conductor.

14. A semiconductor device as set forth in claim 2, wherein the through plug has a columnar electric conductor made of copper

and an insulation layer made of any one of silicon oxide, silicon nitride, and a combination of silicon oxide and silicon nitride, the insulation layer surrounding the columnar electric conductor.

15        15.    A semiconductor device as set forth in claim 3, wherein  
the through plug has a columnar electric conductor made of copper  
and an insulation layer made of any one of silicon oxide, silicon  
nitride, and a combination of silicon oxide and silicon nitride,  
the insulation layer surrounding the columnar electric conductor.

10        16.    A semiconductor device as set forth in claim 1, wherein  
a diameter of the through plug is larger than an interval between  
adjacent ones of the plural diffusion layer patterns.

17.    A semiconductor device as set forth in claim 2, wherein  
a diameter of the through plug is larger than an interval between  
adjacent ones of the plural diffusion layer patterns.

15        18.    A semiconductor device as set forth in claim 3, wherein  
a diameter of the through plug is larger than an interval between  
adjacent ones of the plural diffusion layer patterns.

20        19.    A semiconductor device as set forth in claim 1, wherein  
a diameter of the through plug is larger than a size of the diffusion  
layer pattern.

20.    A semiconductor device as set forth in claim 3,  
wherein a through plug is formed to be partly surrounded by  
the insulation film without being in contact with the plural  
diffusion layer patterns and to pass through the insulation film  
25    and the semiconductor substrate, and

wherein a diameter of the through plug is larger than a size  
of the diffusion layer pattern.